EXHAUST SILENCER

DESCRIPTION

The invention relates to a silencer with the characteristics mentioned in the precharacterising part of claim 1.

Exhaust silencers of the generic type are well known. As a rule, exhaust silencers, most of the time referred to as silencers only, are used for silencing internal combustion engines. A particular type of silencer is used for two-stroke motors, in particular for portable work machinery such as chain saws or the like.

From the state of the art, various solutions to this are already known. DE 37 29 477 C3 discloses a silencer for a chain saw or the like whose housing, which comprises a separation plane, is made from at least two deinstallable parts, comprising an inlet as well as an outlet for exhaust gases escaping from the cylinder of the internal combustion engine. The silencer is arranged directly at the exhaust outlet of the internal combustion engine. The silencer, which comprises two housing halves, is divided into two chambers by an internal separation wall, with the inner separation wall being arranged in a plane behind the housing plane so as to be gas-proof, while the catalytic converter is positioned in an opening of the separation wall, thus providing a connection between the separated chambers. In this way it is possible to arrange the catalytic converter so that it is spaced apart, all around, from the silencer housing, and to feed all the exhaust gas through the catalytic converter.

In a further known printed patent specification, in DE 38 29 668, the particular solution consists of the catalytic converter being arranged in a hollow body from which an exhaust end pipe leads to the silencer outlet. In this solution, too, the catalytic converter is positioned so as to be spaced apart all around from the silencer housing; it is thus possible to lead all the exhaust gas through the catalytic converter and at the same time to cool the exhaust end pipe, using the "cold", untreated exhaust gas. Mixing of treated and untreated exhaust gas is avoided.

Published patent specification DE 198 34 822, examined only as to obvious defects but not as to patentability, shows a solution similar to that disclosed in

DE 37 29 477 described above. In the interior of the silencer housing, which comprises two housing shells, an interior wall as well as a catalytic converter element are provided, with said catalytic converter element being arranged between the exhaust inlet and the exhaust outlet. In order to ensure adequate catalytic treatment of the exhaust gases at low gas back-pressure, a relatively expensive exhaust flow guide arrangement has been provided. In this arrangement, the incoming exhaust flow is divided into partial flows, with at least one of these partial flows being brought into contact with the catalytic converter element, wherein the partial flows are brought together and intermixed before they leave the silencer housing.

Published patent specification DE 25 39 516, examined only as to obvious defects but not as to patentability, also discloses an exhaust device for internal combustion engines, in particular for handheld machines used in agricultural and forestry applications. At its wall which comprises the exhaust outlet, the silencer of the respective exhaust system is covered by a second shell-like wall. Both walls form a cooling channel with a nozzle-like narrowing and with a subsequent widening which leads to the open air and which is preferably diffuser-shaped. The exhaust gases exit in the region of the nozzle-like narrowing and aspirate cool air by means of an ejector effect.

The known solutions are associated with a disadvantage in that the exhaust flow is guided in a complicated path up to the outlet aperture, while after the exiting from a catalytic converter element, said exhaust flow is fed to the outlet aperture without being influenced. As a result of this, inhomogeneous temperatures of the treated exhaust gas are experienced at the outlet aperture, as are temperature peaks, which in particular in the higher load ranges of the internal combustion engine can only be inadequately prevented. Furthermore, pressure pulsations occur in the region of the outlet aperture, which pressure pulsations can then no longer be compensated for.

It is thus the object of the invention to provide a silencer comprising an easily-integrable catalytic converter element of the generic type, which silencer can be variably used for various internal combustion engines of different engine displacement, which silencer achieves low final-temperature values, low sound values, and small pressure fluctuations and in addition allows a space-saving exhaust-flow guide arrangement through the silencer.

According to the invention, this object is met by a silencer comprising the characteristics disclosed in claim 1.

By providing a calming chamber between an outlet area of a catalytic converter element and the outlet aperture from the first housing, in an advantageous way a relatively homogeneous temperature of the treated exhaust gas is achieved, and temperature peaks within the exhaust gas flow are avoided. Any pressure pulsations of the internal combustion engine, arranged upstream, are evened out within the calming chamber. The calming chamber also acts in an advantageous way as a rear silencer arranged downstream of the catalytic converter element. Furthermore, it is advantageous if the calming chamber provides the option, when lined with a corresponding sound-absorbing material, of serving as an absorption silencer.

Furthermore, it is possible in an advantageous way to realise a guide arrangement for the exhaust flow in which arrangement gas-proof cooling tubes are led through the calming chamber, with a liquid or gaseous coolant being fed through said cooling tubes. Advantageously, it is also possible if the calming chamber comprises a catalytic, a heat-insulating and/or sound-absorbing coating, so that the calming chamber fulfils several tasks at the same time.

In a preferred embodiment of the invention, the catalytic converter element is arranged in a second housing which is located within a first housing of the silencer. Essentially, the calming chamber is formed by a second inside of the second housing, by an outlet area of the catalytic converter element and by an insert piece arranged in a recess of the first housing. In this arrangement, the second housing comprises retention angles by which the second housing is attached to a front housing shell of the first housing.

In a further preferred embodiment of the invention the second housing comprises at least one retention plate with a margin, whereby a catalytic converter chamber is formed between an inlet area to the catalytic converter element and the retention plate and the second housing. The catalytic converter material is arranged accordingly in the catalytic converter chamber.

In a further preferred embodiment of the invention, the front housing shell comprises a recess, which at the same time comprises the outlet aperture, with a guide plate being attached to the surface of said housing shell in the region of the recess. An insertion slot is formed between the recess and the guide plate, with spark protection mesh being arrangeable in said insertion slot.

Furthermore, it is preferred if on the front housing shell a cover is arranged which forms an outlet chamber. The outlet chamber comprises a fresh-air aperture and an outlet aperture. Advantageously, the fresh-air aperture is used for mixing the exhaust flow with fresh air. This makes it possible for the temperature of the gas mixed with fresh air to be lowered to such an extent that the exhaust gas temperature in an advantageous way, in the measurement planes specified by registration/approval regulations, safely remains below the legally permissible maximum values. The cover can be shaped such that in the flow path of the treated exhaust gas a narrowing or constriction of the flow channel results, such that a nozzle effect is achieved. This results in fresh air being aspirated in the desired quantity in order to achieve optimal mixing of the treated exhaust gas with fresh air.

Further preferred embodiments of the invention result from the remaining characteristics mentioned in the subordinate claims.

Below, the invention is explained in more detail by means of the associated drawings with reference to an exemplary embodiment. The following are shown:

Figure 1 a perspective view of an exhaust silencer; and

Figure 2 a section of the exhaust silencer according to Line A-A in Fig. 1.

Figure 1 shows an exhaust silencer 100, hereinafter referred to as a silencer. This perspective view essentially shows a front housing shell 32 and a rear housing shell 34 of the first housing 12. The front housing shell 32 comprises a cover 3 which comprises an outlet aperture 42. Figure 1 further shows a mounting device 44 which is used to connect the silencer 100 to an internal combustion engine.

The further elements according to the invention are shown in Figure 2 (section A-A in Fig. 1 of the silencer 100 without mounting device 44). Shown again are the front housing shell 32 and the rear housing shell 34 which form the first housing 12 of the silencer 100. The first housing 12 comprises a first inside 16 of the housing and a first outside 18 of the housing. The first housing 12 comprises an inlet aperture E which leads to an exhaust channel 26. The inlet aperture E is connected to an internal combustion engine such that the exhaust gas to be treated enters the silencer 100 without there being any loss. The exhaust gas to be treated is fed to the first housing 12 by way of the exhaust channel 26. In the interior of the first housing 12 of the silencer 100, in the front housing shell 32 which is preferably removable, there is a second housing 14 into which the catalytic converter element K is placed. The second housing 14 is referred to as the accommodation housing because it accommodates the catalytic converter element K. By means of a retention plate H with an encompassing margin R in the accommodation housing 14, the catalytic converter element K is attached, at corresponding preliminary tension, to a second inside 20 of the accommodation housing 14. The first inside 16 of the first housing 12, together with a second outside 22 of the accommodation housing 14, forms the space in front of the catalytic converter element K.

Preferably, the retention plate H is attached to the second inside 20 of the accommodation housing 14. A catalytic converter chamber KR is formed between the accommodation housing 14 and the retention plate H, with the catalytic converter element K being located in said catalytic converter chamber KR. Furthermore, the accommodation housing 14 comprises an inlet area 28 into the catalytic converter element K, and an outlet area 30 from the catalytic converter element K.

If, depending on the size of the displacement of the internal combustion engine arranged upstream, different sizes of catalytic converters are used or required, the retention plate H is attached at different locations in the accommodation housing 14. This provides the option in a particularly advantageous way of using the silencer 100 for internal combustion engines of different displacement, which engines, as a result of this, require different sizes of catalytic converter elements. As a result of this adaptability, the catalytic converter element K is always safely retained in the accommodation housing 14. It must be ensured that, with a view to meeting the prescribed exhaust emission requirements, the

smallest-possible catalytic converter element K is used, since this is a relatively expensive and heavy component.

The front housing shell 32 comprises a recess D with an outlet aperture A, wherein this outlet aperture A can be configured using different diameters so as to ensure optimal adaptation to the exhaust-gas back-pressure.

However, before the exhaust gas to be treated flows through the outlet aperture A, according to the invention the exhaust flow is fed to a calming chamber 10. Essentially, the calming chamber 10 is formed by the second inside 20 of the accommodation housing 14, by the outlet area 30 of the catalytic converter element K, and by the recess D of the front housing shell 32.

The accommodation housing 14 is attached to the front housing shell 32. As an alternative, the second inside 20 of the accommodation housing 14, which accommodation housing delimits the calming chamber 10 and behind which housing the retention plate H, of which there is at least one, accommodates the catalytic converter element K, can also be constructed in a dual-wall version so that between the housing walls, an air gap is formed as a temperature insulation, sound insulation and/or noise-insulation gap. Optionally, corresponding insulation material can be used.

Adjacent to the calming chamber 10 is a small and a large outlet chamber 44, 38 which is partitioned by spark-protection mesh F to form said small and large outlet chambers 44, 38.

The small outlet chamber 44 is formed by the recess D, the front housing shell 32, and the spark-protection mesh F. The large outlet chamber 38 is formed by the spark-protection mesh F and the cover B.

For the purpose of mounting the spark-protection mesh F, a guide plate L is attached to the front housing shell 32. Together with the recess D, an insertion slot S is formed, into which the spark-protection mesh F can be slid into place. The spark-protection mesh F is additionally secured to the front housing shell 32 by means of an attachment element 24, preferably a self-tapping sheet-metal screw. Installing the spark-protection mesh F prevents any possibility of

secondary reactions between the exhaust flow and the outside air which is rich in oxygen, thus safely preventing any emission of sparks or shooting flames.

As has already been mentioned above, the outlet chamber 38, which has been formed on the outside, is covered by cover B. In addition, mixing of the emanating treated exhaust gas with supplied fresh air takes place in this outlet chamber 38, with said fresh air being able to be fed through a fresh-air aperture 40, preferably in the upper region of the cover B.

The described design of the silencer 100 comprising a first housing 12 and an accommodation housing 14, in which a catalytic converter element K is accommodated, and the calming chamber 10 arranged between the first housing 12 and the accommodation housing 14, not only makes possible variable use of catalytic converter elements K for various internal combustion engines of different displacement, but also ensures the ability to maintain low final temperature values, low sound values, and small pressure fluctuations, while the exhaust gas travels only a short distance through the silencer 100.

LIST OF REFERENCE CHARACTERS

100 Exhaust silencer (silencer)
10 Calming chamber
12 First housing
14 Second housing (accommodation housing)
16 First inside of the housing
18 First outside of the housing
20 Second inside of the housing (accommodation housing)
22 Second outside of the housing (accommodation housing)
24 Attachment element (self-tapping sheet-metal screw)
26 Exhaust channel
28 Inlet area of catalytic converter element
30 Outlet area of catalytic converter element
32 Front housing shell
34 Rear housing shell
38 Large outlet chamber
40 Fresh-air aperture
42 Outlet aperture
44 Small outlet chamber

K Catalytic converter element
H Retention plate
R Margin
KR Catalytic converter chamber
A Outlet aperture
E Inlet aperture
D Recess
F Spark-protection mesh
B Cover
L Guide plate
S Insertion slot